Habitat Study Group Notes
Two Day HSG Retreat: April 15-16, 2009
CalFed Bay Room

Attending: Anke Mueller-Solger (IEP), Jan Thompson (USGS), Ryan Olah (USFWS), Bruce Herbold (USEPA), Fred Feyrer (USBR), Farhat Bahalijiya (CDFG), Steven Detwiler (USFWS), late wednesday only Mike Chotkowski (USBR), Thursday only Ted Sommer (CDWR).

Agenda:

Wednesday:

1) Introductions
2) Status update, progress to date
3) Go over internal schedule
4) Review then further iteration of conceptual models
    - what are we building a conceptual model about?
    - what questions are we trying to address?
    - what proximate hypotheses are we looking to test?
5) Working lunch
6) Continue brainstorm on ideas to incorporate in study plan
    - enumerate explicit statements about our individual hypotheses about what make smelt die or grow
    - compare our CM with those hypotheses
    - does that capture all the questions that we think we should address?
    - how do the inputs to our Fall X2 conceptual model relate to the broader POD models?

Thursday:

7) Brief overview of yesterday's progress
8) Continue brainstorm, wrap up conceptual outline for workplan
9) Working lunch
10) Revisit conceptual model
11) Initial discussion of products/format for May public workshop
12) Next steps, action items, set meeting/call date
13) Adjourn

- The group reviewed the schedule and clarified the proposed milestones.

- There was an update on the scope of the group's activities, covering the HSG progress to date, and mentioning the consensus from last meeting that the group sees itself as a subset of POD and the IEP effort, and would provide a conceptual model consistent with that portion of POD, and integrate to the larger effort through the common members.

- Some members expressed a concern that IEP funding not be drawn away towards fall X2 issues at the expense of the broader suite of POD issues. The group agreed to table the discussion until a quorum was present.

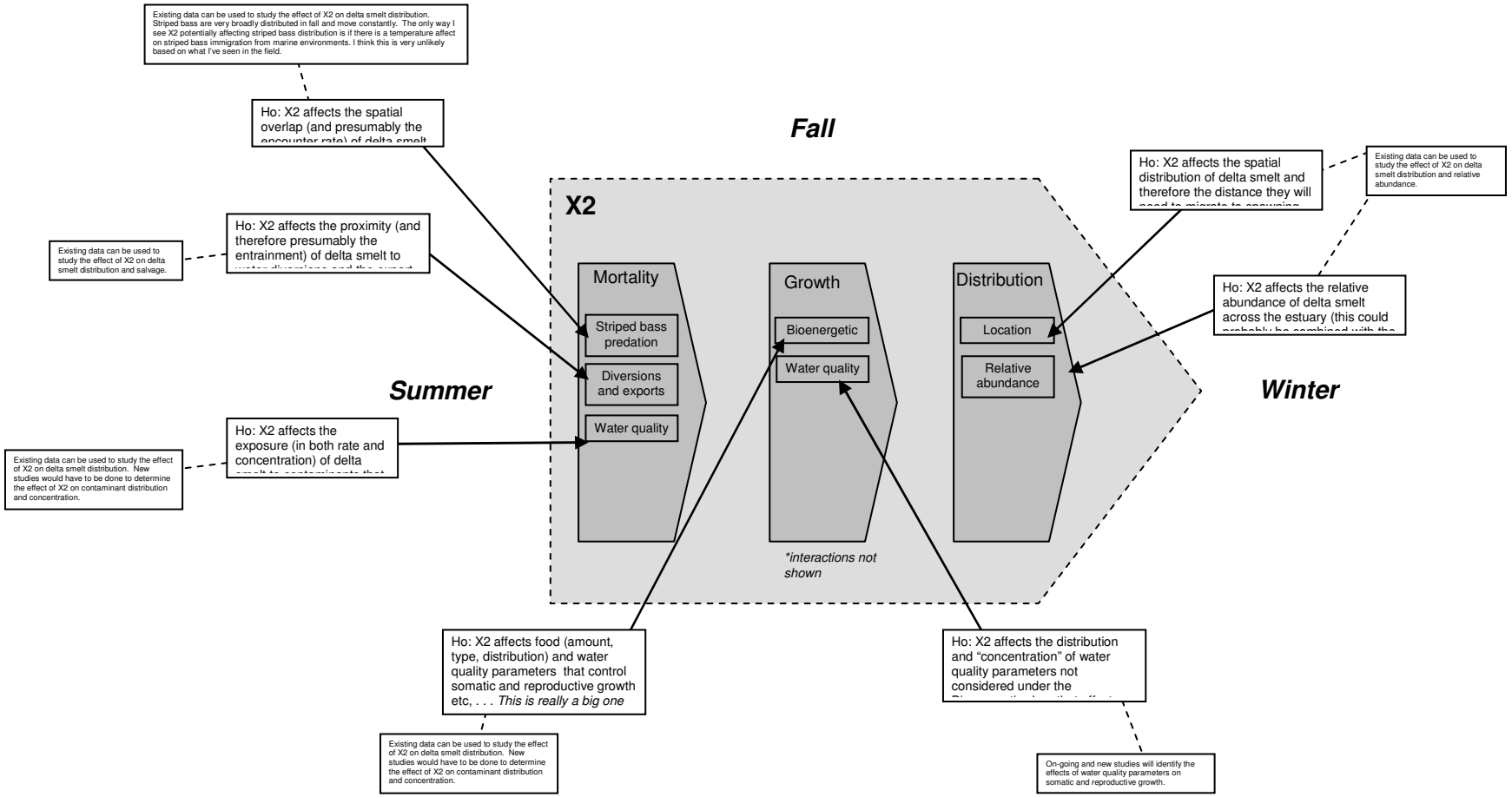
- The framework document is being finalized for public release on the FWS website.

- The issues to resolve over the near-term include:

  - Agenda, format and content for the public workshop
  - Approach Science Program on peer review process and perhaps funding
  - It was suggested that the group should identify issues such as new monitoring stations ASAP so proper planning and permitting may be initiated in time

- We started the working session of the retreat with a presentation of a draft conceptual diagram of relevant outcomes (see below):

DRAFT CONCEPTUAL MODEL



It was explained how there are two relevant ultimate outcomes in the fall: Mortality, and growth. What controls mortality, and what controls growth? These are the important variables to incorporate into the studies. Secondarily, there is the proximate factor of distribution, which has a bearing on these other ultimate endpoints. The drivers for these outcomes appear within the polygons in the diagram. In outline form:

I. Mortality
   A. Striped bass predation
   B. Diversions and Exports
   C. Water Quality (acute effects)
II. Growth
   A. Bioenergetics
   B. Water Quality (sublethal effects)
III. Distribution
   A. Location
   B. Relative Abundance

The group had a discussion regarding the appropriate domain of X2 to incorporate into the monitoring and experimental design. On the one hand, we can only expect to see roughly two scenarios ("treatments") for the next ten years: 84km and 74 km between the frequency of water year types and the off-on toggle for the actions. But are these two scenarios adequate to discern relationships? We set up either a range, which should theoretically exceed these bounds (and isn't this consistent with the group charge?), or we just have two quantized conditions to compare to each other. Are we going to look for pattern with regressions, or just do hypothesis testing between two sample sets? Finally, the issue of what is attainable given limited funding and replicates was raised. The group was split between the pragmatic and tangible two-treatment design (74 km/84 km) and more elegant and inclusive alternatives. <*Note: On day two it was suggested that the effect may well be detectable across a sufficient spread (15km?) of two LSZ distributions*.>

Related points: We're looking at these two scenarios, with the following questions:

1) Is a Suisun Bay connection important?
2) Is a Suisun Marsh connection important?
3) Are natural habitat and islands important?
4) What is the impact of the LSZ in deep river channels?

- In addition, the group discussed the possibility of three treatments @ 70/80/90 km.

- Next, the group turned to a presentation of mechanisms or hypotheses ("stories") about population drivers for delta smelt.

1) Area of Habitat
   - places the population at a greater risk to catastrophic events if they are concentrated

- Young of year striped bass overlaps with more of the delta smelt population and predation pressure increases

2) Cross-seasonal habitat access
- wet springs lead to high dispersion of DS, and is normally associated with larger fall habitat. Dry springs have low dispersion, and similar in fall. But wet springs followed by "dry" falls curtails habitat access and lowers rearing success.

3) Geographic

LSZ in deep channels versus Suisun Bay
- DS are visual predators, more prey are inaccessible when zooplankton are upstream versus downstream
- Productivity etc. issues –phytoplankton
- Proximity of Suisun marsh versus riprap
- Proximity to different delta stressors
- Staging of first flush issues
    - Entrainment
    - Contaminants

4) Trophic Impacts
- Stable flow/salinity regimes/nutrient regime (NH_4^+, P, NP ratio) favors
    - Overbite clam
    - Jellyfish
    - *Microcystis*
- Loss of productivity due to higher exports
    - Organic Carbon
    - Zooplankton
    - phytoplankton
- Turbidity maximum =(?) LSZ =(?) highest zooplankton densities

Physics behavior

- Next, the group turned to hypothesis building within the outcomes enumerated in the outcomes diagram above:

MORTALITY

Predation: <Existing data good>.

H1: Distribution of delta smelt does not change with respect to two X2 positions

H2: Distribution of striped bass does not change with respect to two X2 positions

H3: Young of year striped bass eat delta smelt (if we have existing data or experiment to start testing). It would be interesting to know the size threshold.

H4: Young of year striped bass and delta smelt peak densities in distribution coincide. Historical data scale may be too rough.

H5: Higher concentrations of delta smelt attract adult striped bass to feed on them. Changes in temperature trigger the migration.

Diversions and Exports:

H1: X2 affects the proximity of delta smelt to export facilities and diversions

H2: Delta smelt distributed further east fish are more prone to State and Federal export facilities

Water Quality: (acute effects)

H1: X2 affects the exposure of delta smelt to contaminants causing acute mortality
- Easterly is presumed worse in terms of catastrophic events and risk

H2: Dilution effect from moving X2 seaward will protect DS
- been done in PTM and the hydrodynamic models
- residence time probably the biggest thing
- it can get complicated in the Bay, in that what you assume is diluted is not see Honker Bay and Schoelhamer work, get some sediment trapping in Grizzly Bay.
- Look at volume of delta outflow (this is more sublethal and growth)

DISTRIBUTION

Location:

H1: X2 affects the spatial distribution of DS and therefore the distance that delta smelt will need to migrate to spawning habitat

H2: The overlap or proximity of spring habitat to fall habitat will control the growth (and survival) of DS. Wet spring equals broad distribution. Fall habitat historically also large. Habitat access high. Dry springs leave concentrated habitat range, but coincident to fall availability. Since 2000 wet springs have high dispersion followed by dry year concentration in habitat and reduced success in DS migration to good rearing habitat.

H3: Channels versus the Bay offer different foraging success. Visual predators in dark channels may render prey unavailable to them as opposed to further down.

H4: The proximity of marsh and other high productivity areas differed between 74 and 84km

H5: The proximity to Delta stressors is different between the two positions. Look at these stressors like TBT @ mothball vs 84km contaminants

H6: Sensitivity to first flush contaminant pulses related to position. In channels vs distributed across the Suisun Bay.

GROWTH (and Fecundity)

Bioenergetics:

H1: X2 affects food amount or food intake

- The higher X2 values reflect hydrodynamic differences in the Delta that change the fate of zooplankton transport by reducing downstream transport.
- Difference between export losses and transport downstream (seaward)
- Foraging efficiency higher in more shallow waters than deeper channels
- Higher X2 in fall results in higher clam recruitment (distribution and biomass) in fall which results in higher spring biomass in normal to dry years
- Higher X2 in fall results in broader *Corbula* recruitment
- *Microcystis* as poor food for pseudo decreases prey for DS
- *Microcystis* may suppress fish feeding

H2: X2 affects food type

- impacts zooplankton composition by changing transport as the higher X2 values means there is less *Pseudodiaptomus* transport into LSZ
- High X2 results in wider distribution and abundance of clams which reduce cell size in phytoplankton, and that may impact zooplankton
- High X2 results in wider distribution and abundance of clams which increases predation on *Pseudodiaptomus* nauplii
- *Microcystis* abundance and distribution is influenced by X2, this changes overlap with consumers (including fish?)
- Gelatinous zooplankton abundance and distribution is influenced by X2, this changes overlap with prey (including fish?)

H3: Variability of X2 conditions driving community ecology

- Higher X2 in fall followed by normal to dry springs results in higher spring corbula biomass and therefore more thorough water column clearing
- Less or more diatoms when X2 landward results in fewer diatoms within the range of our pelagic fish (salt or flow issue?...diatoms grow quickly and can handle fast flows cyano need stagnant water also ciliates as slow growers can hang more with landward X2. Basic response is # diatoms
- more or less protozoa, same as above w/o all the mechanisms
- Ciliates a bigger portion of the web, but how related to X2?
- State change of ecosystem under regimes between two pelagic communities where benthic and littoral is more important than before. Can you revert to diatom based pelagic systems if you removed the clams? Better understand dynamics with shift in X2 positions. Part of regime shift is based on

variability not just static positions. If the two endpoints are overlapping or close to overlapping chances of success are low if the issue is benthic. Is there something in the spring to extrapolate to fall utilizing that variability? What is particularly sensitive, where would tidal excursion matter more or less? *Corbula* would take a flood exceeding our infrastructure capacity to remove.

H4: Temperature effects from shifting X2

- may increase marine air influence etc to enhance habitat quality or bioenergetic success by reduced physiologic demand.
- High T @ extremes leads to tradeoff for salinity expansion of range.

H5: Salinity impacts physiology through stress response energy costs.

H6: Antecedent conditions impact fitness in a way that determines magnitude of all effects covered herein.

Water Quality: (chronic effects on growth and fitness)

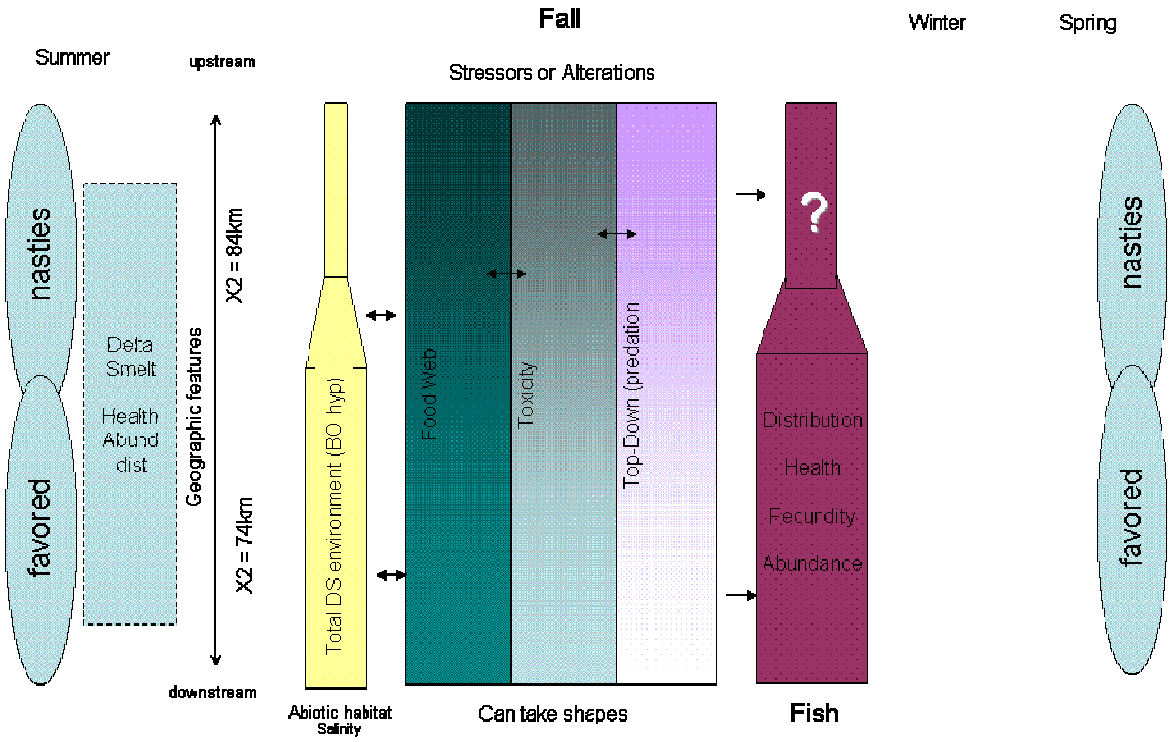
H1: X2 affects WQ parameters that control somatic and reproductive growth

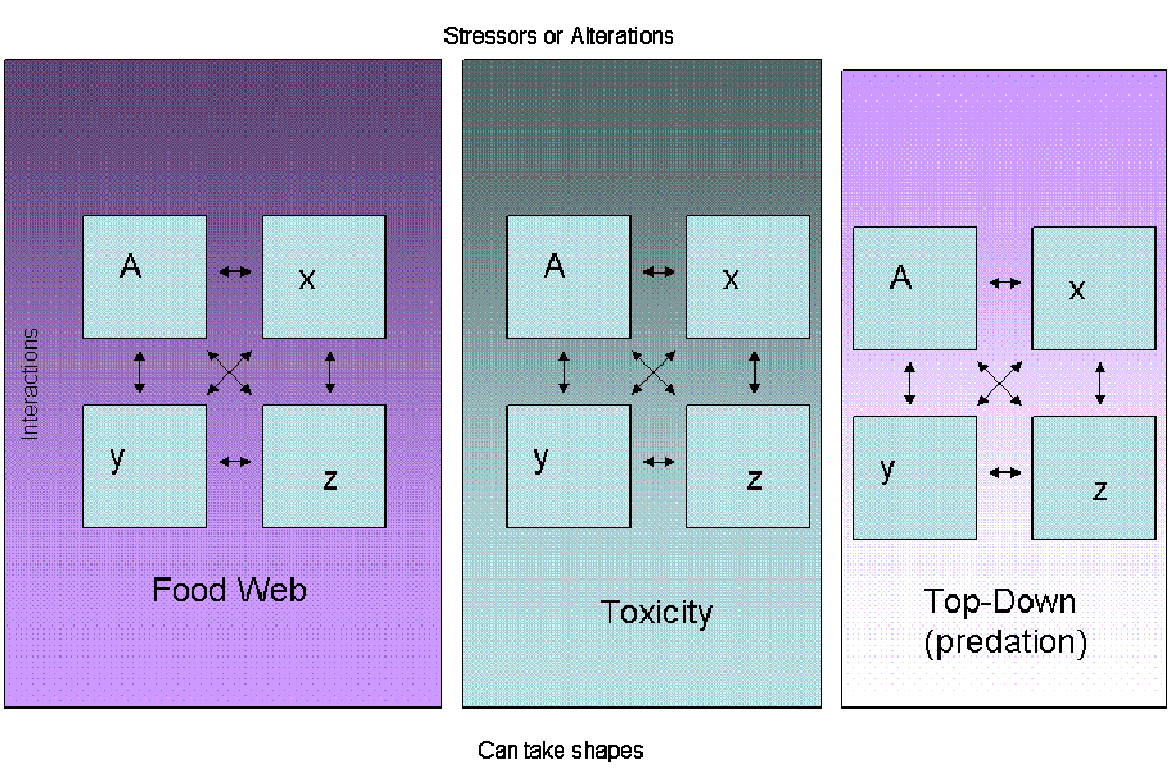
- *Microcystis* movement and mortality becomes WQ issue
- TBT off mothball fleet at concentrations that matter? Not seen in Jan's data but there is a hotspot at Mare Island. NOAA report.
- Organics include high loading during first flush from orchard pesticides. Toxicity observed in organisms higher in later part of year than earlier, but haven't looked at data wrt X2.
- Exposure to higher concentrations of contaminants with upstream X2. If there's higher ezposure, acute and chronic effects, but also migratory ability and ability to find each other.
- Other metals include Se and Ag from concord weapons station halfway between Chipps and Carquinez and first gulf war(?) peaking around Carquinez at concentrations that can affect bivalve reproduction. Still get a Se spike in Carquinez area. So far methyl-hg in deepwater clams is of concern. Shallow water like Suisun we don't know methylation rates need to study.
- Closer to Sac regional increases probability of exposure to toxic concentrations of ammonia (year round rather than seasonal dumping)
- Endocrine disruptors (Contra Costa TP @ Carquinez?; Travis AFB into Suisun).

H2: Disease/Immunocompetence.

- When X2 is upstream, they are more diseased through stress-mediated mechanisms.

- The group engaged in a round of conceptual model formulation, resulting in these drafts:


Fall
Winter
Spring
Summer
upstream
Stressors or Alterations
nasties
favored
Delta Smelt
Health
Abund
dist
Geographic features
X2 = 84km
X2 = 74km
downstream
Total DS environment (BO hyp)
Food Web
Toxicity
Top-Down (predation
?
Distribution
Health
Fecundity
Abundance
nasties
favored
Abiotic habitat
Salinity
Can take shapes
Fish
FILTER


Fall
Stressors or Alterations
Interactions
A
x
y
z
Food Web
A
x
y
z
Toxicity
A
x
y
z
Top-Down
(predation)
Can take shapes
FILTER

May Workshop—

Tentative May 28 (1PM @ CalFed building) Tentative Agenda:

1) Introduction
2) Framework and scope
3) Fit with POD and IEP
4) Presentation of Conceptual Model
5) Adaptive Management Process
6) Peer Review and Public Technical Input Opportunity

Homework:

Circulate notes (Steve)
Finalize model diagrams (Steve) to group for review for adding narrative to model
Fit hypotheses to boxes in Herbold/Feyrer 3/23 blackboard model (Bruce)
Find location and coordinate May workshop (Steve)
Coordinate with SP on peer review needs (timing, materials etc.) (Anke)

Next Meeting: Call on Thursday @ 1PM